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Killworth, Gottman, Hagan & Schaeff, LLP

One Dayton Centre
One South Main Street, Suite 500
Dayton, Ohio 45402-2023

937.223.2050
Fax | 937.223.0724
E-mail | kghs@kghs.com

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Application of

Applicants	**:David R. Hembree et al.**
Serial No.	**:09/510,828**
Filed	**:February 23, 2000**
Title	**:A SPRING ELEMENT FOR USE IN AN APPARATUS FOR ATTACHING TO A SEMICONDUCTOR AND A METHOD OF MAKING**
Docket No.	**:MIO0020VA (97-0198.02)**
Examiner	**:J. Mitchell**
Art Unit	**:2822**
Confirmation	**:4071**

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OFFICIAL AMENDMENT

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Assistant Commissioner for Patents
Washington, D.C. 20231

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Thomas E. Lees — 46,867 Reg. No.

Sir:

AMENDMENT

This paper is being filed in response to the Office Action dated March 30, 2001 in the identified application, having a reply due date of June 30, 2001. Reconsideration is respectfully requested in light of the amendments and remarks below.

IN THE SPECIFICATION

Please amend the paragraph starting on page 13, line 13 to read:

The force applied by the spring element 22 may be changed by changing the area of the spring element 22 to be compressed. For example, a pressure plate 20 which is larger than the outer dimensions of the semiconductor 12 may be used with a lower psi spring element 22. The larger pressure plate 20 limits the overall compression height of the spring element 22 while applying the appropriate amount of force. Reducing the amount that the spring element 22 is compressed lessens the compression set of the spring element 22.

IN THE CLAIMS

The entire set of presently pending claims is reproduced below for the convenience of the Examiner. The claims have not been amended.

29. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastomeric member and a conductive member.

30. The apparatus of claim 29, wherein said conductive member comprises a plurality of conductive particles.

31. The apparatus of claim 29, wherein said plurality of conductive particles are interspersed within said elastomeric member.

36. The apparatus of claim 29, wherein said conductive member is comprised of conductive material selected from the group consisting of gold, aluminum, nickel, silver stainless steel, and alloys thereof.

37. The apparatus of claim 29, wherein said semiconductor is electrically biased through said spring element.

38. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die.

39. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die formed within a semiconductor package.

40. The apparatus of claim 39, wherein said semiconductor package comprises a package selected from the group consisting of a chip-scale package, a ball grid array, a chip-on-board, a direct chip attach, and a flip-chip.

44. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and a first elastic member comprised of a first elastomeric material having a first modulus of elasticity, said first elastic member having a plurality of holes formed therein such that said spring element has an overall modulus of elasticity different from said first modulus of elasticity.

45. The apparatus of claim 44, wherein said spring element further comprises an elastic member comprised of a second elastomeric material having a second modulus of elasticity, said second elastic member positioned in at least one of said plurality of holes formed in said first elastic member such that said overall modulus of elasticity is different from said first and second moduli of elasticity.

46. The apparatus of claim 44, wherein said spring element further comprises a plurality of second elastic members positioned in a plurality of said plurality of holes in said first elastic member.

47. The apparatus of claim 44, wherein said conductive member comprises a plurality of conductive particles.

50. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastic member comprised of a conductive member and an elastomeric material having a modulus of elasticity, said elastic member having a hole formed therein such that said spring element has an overall modulus of elasticity different from said modulus of elasticity of said elastomeric material, said elastic member being shaped so as to engage an outer edge of said semiconductor such that a force applied by said attachment device as said interconnect

structure is pressed against said semiconductor is substantially uniform around said semiconductor.

51. The apparatus of claim 50, wherein said conductive member comprises a plurality of conductive particles.

54. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a first conductive member, a first elastic member and a second elastic member, a first elastomeric material having a first modulus of elasticity and said second elastic member comprising a second elastomeric material having a second modulus of elasticity, said second elastic member being positioned within said first elastic member such that said spring element has an overall modulus of elasticity different from said first and second moduli of elasticity.

55. The apparatus of claim 54, further comprising a plurality of said second elastic members formed within said first elastic member.

56. The apparatus of claim 54, wherein said conductive member comprises a plurality of conductive particles.

63. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member comprised of an elastomeric material having a modulus of elasticity, said elastic member having at least one cavity formed therein such that said spring element has an overall modulus of elasticity different from said modulus of elasticity of said elastomeric material.

64. The apparatus of claim 63, wherein said elastic member has a plurality of cavities formed therein.

65. The apparatus of claim 63, wherein said conductive member comprises a plurality of conductive particles.

68. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member having a variable spring constant.

69. The apparatus of claim 68, wherein said conductive member comprises a plurality of conductive particles.

73. The apparatus of claim 29, wherein said conductive member comprises carbon.

REMARKS

Claims 29-31, 36-39, 44, 50, 51, 63-65, 68, 69, and 73 were rejected under 35 U.S.C. §103(a) as being unpatentable over US 5,519,332 issued September 29, 1998 to Farnworth et al. (hereinafter "Farnworth") in view of IEEE article "A Comparison on Metal-in-Elastomer Connectors: The Influence of Structure on Mechanical and Electrical Performance" published June 1991 by Rosen et al. (herein after Rosen).

The applicants submit that the Farnworth is not prior art for purposes of 35 U.S.C. §103.

This application is a divisional of US Patent Application Serial No. 09/026,080, filed February 19, 1998, which is a continuation in part of US Patent Application Serial No. 09/009,169 filed January 20, 1998. Accordingly, with respect to the above claims, the effective filing date is at least February 19, 1998. Farnworth issued September 29, 1998 and was filed December 20, 1995. Accordingly, the above rejection under 35 U.S.C. §103 is via 35 U.S.C. §102(e).

However, subsection 103(c) clearly states that

> Subject matter developed by another person, which qualifies as prior art only under one or more of subsections (e), (f), and (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

According the MPEP §706.02(l)(3), common ownership can be established through the assignment records on file at the Patent Office. Micron Technologies, Inc. is identified as the assignee on the face of Farnworth. Further, Micron Technologies, Inc. is the assignee of the pending application. Enclosed as Exhibit A is a copy of the

Assignment, postcard, and stamped returned postcard filed in the parent application (US Patent Application Serial No. 09/026,080) from which this divisional is based. According to the MPEP §201.12, the assignment in a parent carries to a divisional. Further, enclosed as Exhibit B is a copy of the Assignment, postcard, and stamped returned postcard filed in the original application (US Patent Application Serial No. 09/009,169, assignment recorded at reel 8952, frame 0604) from which both the CIP and the present application are based. Accordingly, subsection (c) of Section 103 makes it clear that Farnworth is not available as prior art in the present application. This assertion holds true even though the present application and Farnworth name different inventive entities.

Further, the Examiner has provided no reference that teaches a spring element including an elastomeric member and a conductive member. In fact, the Examiner is apparently relying on Rosen to suggest that a metal placed in an elastomer for purposes of forming an interconnect renders obvious a *spring element* for use in a semiconductor testing apparatus. There is no suggestion or teaching anywhere in Rosen or any art cited by the Examiner to support this assertion.

Firstly, Rosen teaches embedding metallic conductors oriented in the *z*-direction of an elastomeric substrate. By properly positioning the conductors with respect to the insulator (elastomeric material), an anisotropic conduction of electrical current is realized. It is clear that the structures described by Rosen are *electrical connectors* to provide an *interconnect* for separable high-density media. Rosen does not suggest at all that such a construction would make a suitable spring element as claimed.

For example, as shown in Fig. 1 of the present invention, the test apparatus includes a package base 14, an interconnect 16 inserted into the package base, a semiconductor 12 coupled to the interconnect, an optional pressure plate 20 that presses on the semiconductor, a spring element and a cover 24. The cover

compresses the spring element into the semiconductor (and optional pressure plate) to establish good electrical characteristics between the semiconductor and the interconnect, and the interconnect and the package base.

The spring element must be able to absorb some of the force or pressure applied to it as it is compressed by the cover. Additionally, the spring element must be sized and configured to transfer a desired amount of pressure to the semiconductor. A sufficient amount of pressure needs be applied to the semiconductor so that it properly engages the interconnect structure. However, an excessive amount of pressure could damage the semiconductor and the interconnect structure. As the dimensions of the spring element are limited due to the size of the semiconductor and the package, the configuration of the spring element may be changed so that it exhibits the desired pressure absorption and force transfer characteristics. In other words, the force applied by the spring element may be changed by changing the area of the spring element to be compressed (See specification page 13, lines 3-14).

The structure taught by Rosen is an interconnect. Accordingly, one would not want to modify its area, because to do so would potentially disrupt the conductive traces therein. Further, because the structure of Rosen is an interconnect, it is meant to couple electrical elements together using the conductors running through the elastomer. Such a structure is not intended to be used to exert a force against a semiconductor to press a semiconductor into an interconnect, and such a structure is clearly not intended to bias a pressure plate against a semiconductor.

With respect to claim 44, the Examiner argues that it would be obvious to one having ordinary skill in the art to form a plurality of holes within a first elastic member because it only requires routine skill in the art to duplicate holes. However, according to the M.P.E.P. § 2143.01, the fact that the claimed invention is within the capabilities of

one of ordinary skill in the art is not sufficient by itself to establish *prima facie* obviousness. There must be some objective reason to modify the references. The level of skill in the art cannot be relied upon to provide the suggestion to combine references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See also *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

The applicants assert that the plurality of holes is more than a mere duplication. As pointed out above, the spring element is adjustable to ensure that the proper force transfer characteristics are provided so that the semiconductor makes suitable electrical contact with the interconnect. Accordingly, the quantity and location of the holes is determined to achieve particular force transfer characteristics.

The Examiner did not meet the burden of establishing a *prima facie* case of obviousness. The references cited fail to teach all of the limitations of the present claims, and there is no motivation provided to combine or modify the references as required by the MPEP §706.02 (j). Accordingly, the applicants request the Examiner withdraw the rejection.

Claims 45, and 54-56 were rejected under 35 U.S.C. §103(a) as being unpatentable over Farnworth and Rosen in further view of US 5,192,479 issued March 9, 1993 to Karasz et al. (herein Karasz). The Examiner has not established a *prima facie* case of obviousness for the above claims. According to the MPEP §706.02(j), to establish a *prima facie* case of obviousness, the prior art reference must teach or suggest all the claim limitations. Further, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.

As pointed out above, Farnworth cannot be used as a reference against the present application. Further, neither Rosen or Karasz teach an attachment device pressing an interconnect structure against a semiconductor, the attachment device comprising a spring element including a conductive member, a first elastomeric material, and a second elastomeric material.

Further, there is no motivation provided in any of the references cited by the Examiner that would suggest that Karasz could be modified to render obvious the claimed invention. Firstly, Karasz does not teach a first elastomeric material having holes therein, and a second elastomeric material inserted in at least one of the holes. It should be observed from the remarks above that one purpose of the spring is to provide the proper force transfer characteristics to form good electrical contact of a semiconductor against an interconnect. By controlling the amount of second elastomeric material in the first elastomeric material, the force transfer characteristics of the spring may be modified.

In contradiction, Karasz teaches forming miscible polymers at practical temperature ranges. For example, Karasz discloses an elastomer dispersed throughout a *thermoplastic*, and a thermoplastic dispersed throughout an elastomer. However, miscible polymers are not the same thing as forming a hole in a first elastomeric material, where a second elastomeric material is positioned in at least one of the holes. In fact, Karasz does not teach a first elastomeric material in a second elastomeric material. Further, there is no indication in the reference that force transfer characteristics of a spring may be modified with such a miscible polymer structure.

The references, even when combined fail to teach all of the limitations to the above claims. Therefore the applicants request the Examiner withdraw the above rejection.

Finally, the applicants note that claims 40, 46 and 47 were identified on the cover sheet as being rejected. However, no justification for such a rejection could be found in the body of the Action. Accordingly, if such claims actually are rejected, the applicants request an explanation as to the basis of the rejection. Otherwise, the applicants request the rejection be withdrawn.

CONCLUSION

For all of the above reasons, the applicants respectfully submit that claims 29-31, 36-40, 44-47, 50, 51, 54-56, 63-65, 68, 69 and 73 represent allowable subject matter. The Examiner is encouraged to contact the undersigned to resolve efficiently any formal matters or to discuss any aspects of the application or of this response. Otherwise, early notification of allowable subject matter is respectfully solicited.

Respectfully submitted,
KILLWORTH, GOTTMAN, HAGAN & SCHAEFF, L.L.P.

By _____
Thomas E. Lees 46,867

One Dayton Centre
One South Main Street, Suite 500
Dayton, Ohio 45402-2023
Telephone: (937) 223-2050
Facsimile: (937) 223-0724